# TOPIC 09 – REDOX
# 9.4 – VOLTAIC CELLS

IB Chemistry

T09D03

Mr. Martin Brakke

# 9.4 – Voltaic Cells

- 9.4.1 Explain how a redox reaction is used to produce electricity in a voltaic cell. (3)
- 9.4.2 State that oxidation occurs at the negative electrode (anode) and reduction occurs at the positive electrode (cathode). (1)

Mr. Martin Brakke

# How does Redox Produce Electricity?

9.4.1 Explain how a redox reaction is used to produce electricity in a voltaic cell. (3)

- There are two types of electrical charge, positive (+) and negative (-).
  - Like charges repel
  - Opposite charges attract
  - Electric Charge is measured in **coulombs** (C)
  - Electrons have a charge of $1.6 \times 10^{-19}$ C
  - In a circuit, charge flows through wires and is carried by electrons which flow from Negative → Positive terminals

Mr. Martin Brakke

# Current and Voltage

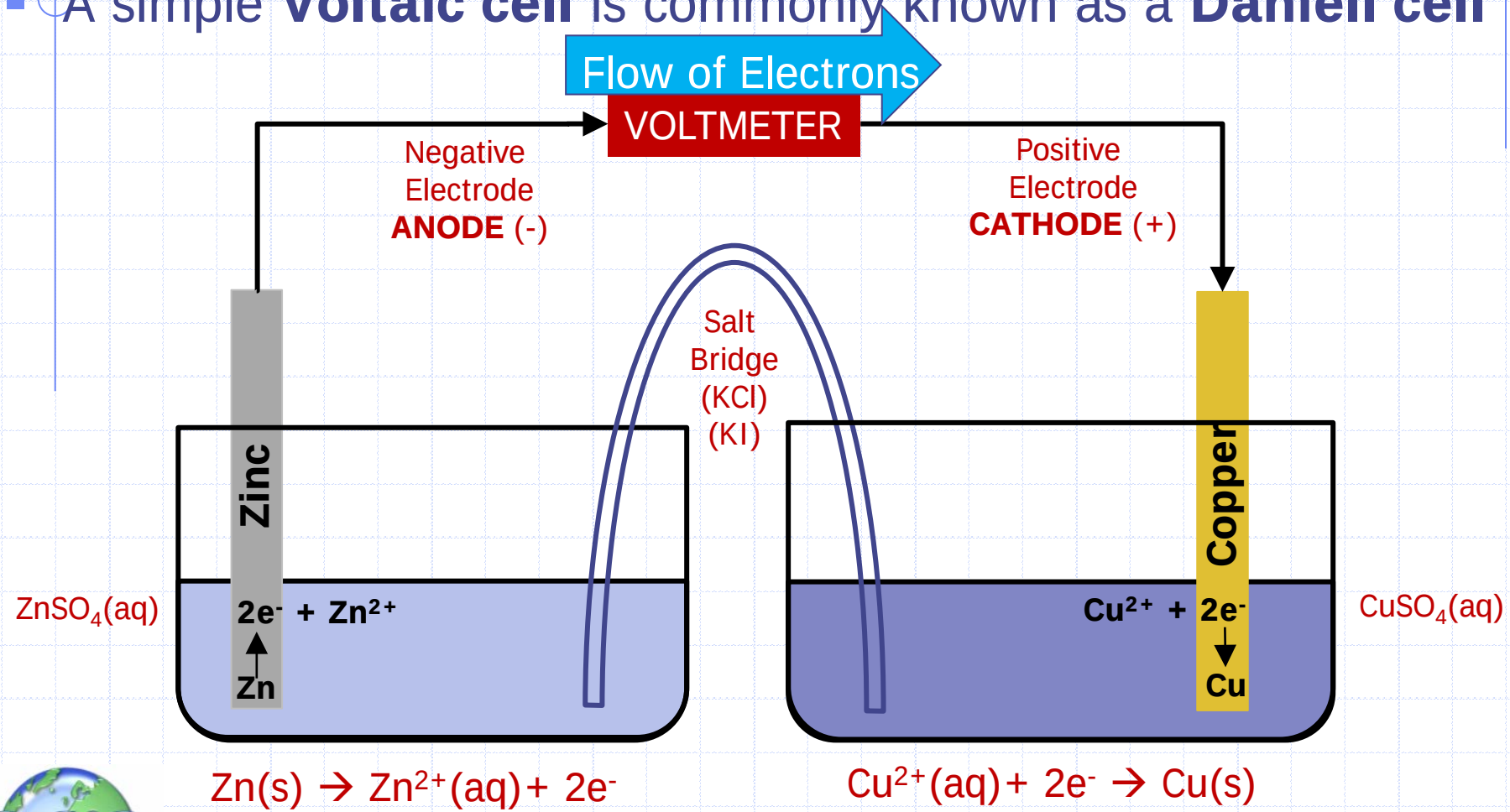
- The rate at which electric charge flows through the circuit is known as the **current**, which is measured in **amperes** (amps, A)
  - A large current could be produced by
    - A large amount of charge moving slowly
    - A small amount of charge moving quickly
- An electrical current flows through a circuit if there is a potential difference between electrical potential in two points of the circuit
- **Potential difference** is measured in **volts** (V) and is termed voltage
  - One volt gives a charge of one coulomb one joule of energy.

Mr. Martin Brakke

# Voltaic Cell Diagram

9.4.2 State that oxidation occurs at the negative electrode (anode) and reduction occurs at the positive electrode (cathode). (1)

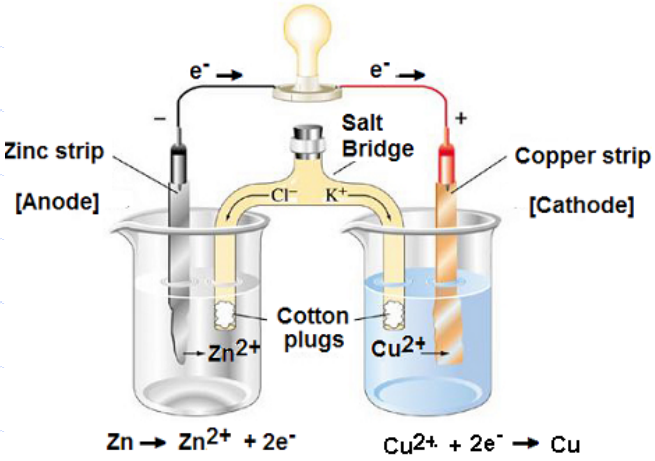
- A simple **Voltaic cell** is commonly known as a **Daniell cell**

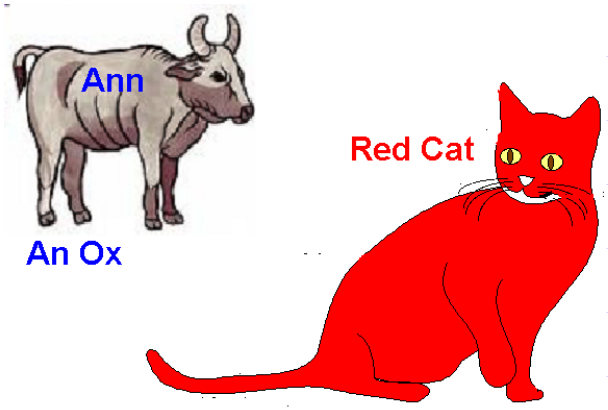


Mr. Martin Brakke

# Beyond the Diagram

- The electrons flow from the surface of the Zn electrode through the external circuit to the Cu electrode
- The process continues until either:
  - Zinc electrode is gone
  - $Cu^{2+}$ ions are consumed
- By definition, the
  - **anode** is where oxidation occurs
    - An Ox (**AN**ode is **OX**idation)
  - **cathode** is where reduction occurs
    - RedCat (**RED**uction is on the **CAT**hode)



Mr. Martin Brakke

# What does the Voltage Mean?

- The volt reading is a measure of the **cell potential** of the system
- The voltage depends on:
  - Nature of the electrodes
  - Nature of the ions in solution
  - Concentrations of the solutions
  - Temperature of the solutions

Mr. Martin Brakke

# Shorthand Notation for Voltaic cells

- The shorthand representation of an electrochemical cell showing the two half-cells connected by a salt bridge or porous barrier, such as:

$$Zn_{(s)}/ZnSO_{4(aq)}//CuSO_{4(aq)}/Cu_{(s)}$$

anode cathode

The electrodes are shown on the ends and the electrolytes for each side are shown in the middle.